A New Approach to Optimizing Recovery: PRTISP Process*

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Abstract

PRTISP (Pulse Resonance Thermal Injected Syngas Process), still in the conceptual state, is a combination of four existing heavy oil recovery processes:

- Steam flooding: Steam flooding is a commercially developed process for heavy oil recovery.
- Gas injection: Gas injection is also a commercially developed process but for light oil recovery; here, it is combined with steam injection in a TTH configuration, to enhance steam flood efficiency.
- Pulse technology: The pulse technology has been validated for light and medium oils with oil viscosities up to a few hundred centipoises. It has a starting point in the ability of earthquakes to increase oil production; at this time it is almost a commercial method for stimulation of light oil reservoirs production in which no gas injection took place. It is not proven yet for very heavy oils. (Dr. Peter Roberts, Las Alamos National Laboratory).
- Toe-to-heel short distance oil displacement: Toe-to-heel displacement configuration has been validated through a 2.5-year successful field piloting of the Toe-to-Heel Air Injection (THAI) process by Petrobank Energy and Resources; it is not commercially validated yet.

It is thought that the combination of these processes, if integrated properly and applied effectively, could accelerate fluid flow in porous media and increase oil recovery significantly. PRTISP is perceived to be cost-effective and environmentally friendly.

“A New Approach to Optimizing Recovery” **PRTISP Process**

March 09-13, 2015

San Antonio Texas

What if You

- Combine 4 proven technologies (Pulse, Thermal, Solvent Gas Injection, Steam) into 1 process?
- Make the process controllable to maximize production?
- Maximize Energy potential, capture and capitalize?

What would this technology be worth to any Oil producer?

- Why:
  - Increase oil production by a minimum of 7-10%, lab tests identify up to 76% in some cases.
    - Changes to reserves ratings, Proven, probable and possible
  - Increasing oil mobility by changing the phase permeability.
  - Capturing energy potential, capitalization of any loss energy and applying it either back into the project or turn it into capital (Putting power into the Grid).
  - Activating old fields/abandonments and producing those fields with secondary recovery, little capital cost.
  - Capitalization of production, taking wet field gas, stripping it of its wet gases; captures them for production and then uses only waste gas for the process.

Who has been involved with the Development of PRTISP

- Harold Nikipelo
  - Sole designer /inventor of PRTISP and downhole tool; President of Lifeview Oil and Gas Management Services
- Dr. Alex Turta, Alberta Research Council Calgary, Advisor to PRTISP process only
  - Head of the Enhanced Oil Recovery
  - Co-designer of THAI,
  - Author of many EOR papers
- Dr. Kenny Adegbesan, KADE technologies Technical Advisor
- Geologists, Petroleum and Mechanical Engineers

Building a better Mouse Trap

Current heavy and conventional Oil Recovery Technologies.

- THAI & CAPRI
- SAGD
- Solvent Injection
- Electrical energy
- Water flooding
- Gas Injection

The Concept & Benefits to you

- When effectively implemented, we believe our process may be
  - the most efficient way to accelerate fluid flow and disperse liquids through oil-bearing geological formations
  - Increase oil production
  - Economically efficient production, thanks to better oil mobility and anticipated well efficiency
  - Cheaper Facility due to less steam being generated
  - Power generation excesses tool requirements, thus putting power back into the grid system

- The process of the present invention is adaptable for use in reservoirs including but not limited to the following:
  - Reservoirs with high viscosity bitumen or heavy oil
  - Reservoirs with mobile bottom water
  - Reservoirs with difficult cap rock integrity issues
  - Reservoirs with depths less than 4500m(14,763ft.) / dependent on power usage for reheating gas.
  - Reservoirs with narrow or restricted net pay > 6 meters
  - Reservoirs with depletion drive mechanisms for heavy oil extraction and light oil as well.
  - Reservoirs for conventional oil production

WHAT IS PRTISP?

- Pulse
- Resonance
- Thermal
- Injected
- Syngas
- Process

Pulse

- The process is a pulsing drive system the causes penetration within the reservoir through pressure gradient changes, development of elastic pressure waves (P-WAVES).
- Controllable above surface for maximum production.
- Each segment is controllable.
- Maximum benefit supersedes any known enhanced oil recovery program developed..
- The pulsing mode is adjustable based on design and exhaust port length. (Lifeview Pulsation Tool)
- Continuous application

Resonance

- The **Sonic Resonance Frequency generated** by the pulse and tool would be regulated, based on both temperature and amplitude for the regulation of the wave's magnitude of oscillation.
- Causes penetration to within the reservoir and will generate flow to the production well.
- The sonic frequency is calculated to ensure cap rock integrity and reservoir structure is maintained by Geomechanical methods and testing.

Thermal

- The **thermal** temperature of the exhaust gases are regulated to meet the engineering working specifications as set forth based on reservoir perimeters.
- Prior to exit point of the downhole pulsation tool, the gases will pass through a downhole heater (adjustable) thus increasing the temperature prior to being expelled through the downhole pulsation tool expulsion ports.
- Treated water/steam would be injected on the exhaust side. Steam Expansion (1700 times) Ideal Gas Law. An ideal gas can be characterized by three state variables: absolute pressure (P), volume (V), and absolute temperature (T). The relationship between them may be deduced from kinetic theory and is called the
- Ideal Gas Law: PV=nRT=NkT

Injected

- The **injection of water or steam** (treated) will be used to increase the mobility of the oil or bitumen flowing to the production well by applying wet steam or water downhole in direct contact with high temperature gaseous. (243 degrees C/ 469.4 Deg. F)
- Designed downhole pulsation tool. This will harness the steam expansion characteristics to pulsate movement of the oil by **dilating the natural fractures** without causing damage to cap rock integrity.
- Toe to heel configuration well will be used.
- This **short- distance oil displacement** will preserve the upgrading. This benefit has been demonstrated in other existing enhanced oil recovery processes and can be controlled to meet the required benefit.

Syngas

- The use of propane or natural gas as a main fuel source along with other thermal operations to produce its by-products **(SYNGAS)** would be used as a solvent gaseous solution based on the reservoir requirements. (Treated Flu Gas)
- Recycle through a afterburner for complete burn removing all oxygen from the injection gas

Process

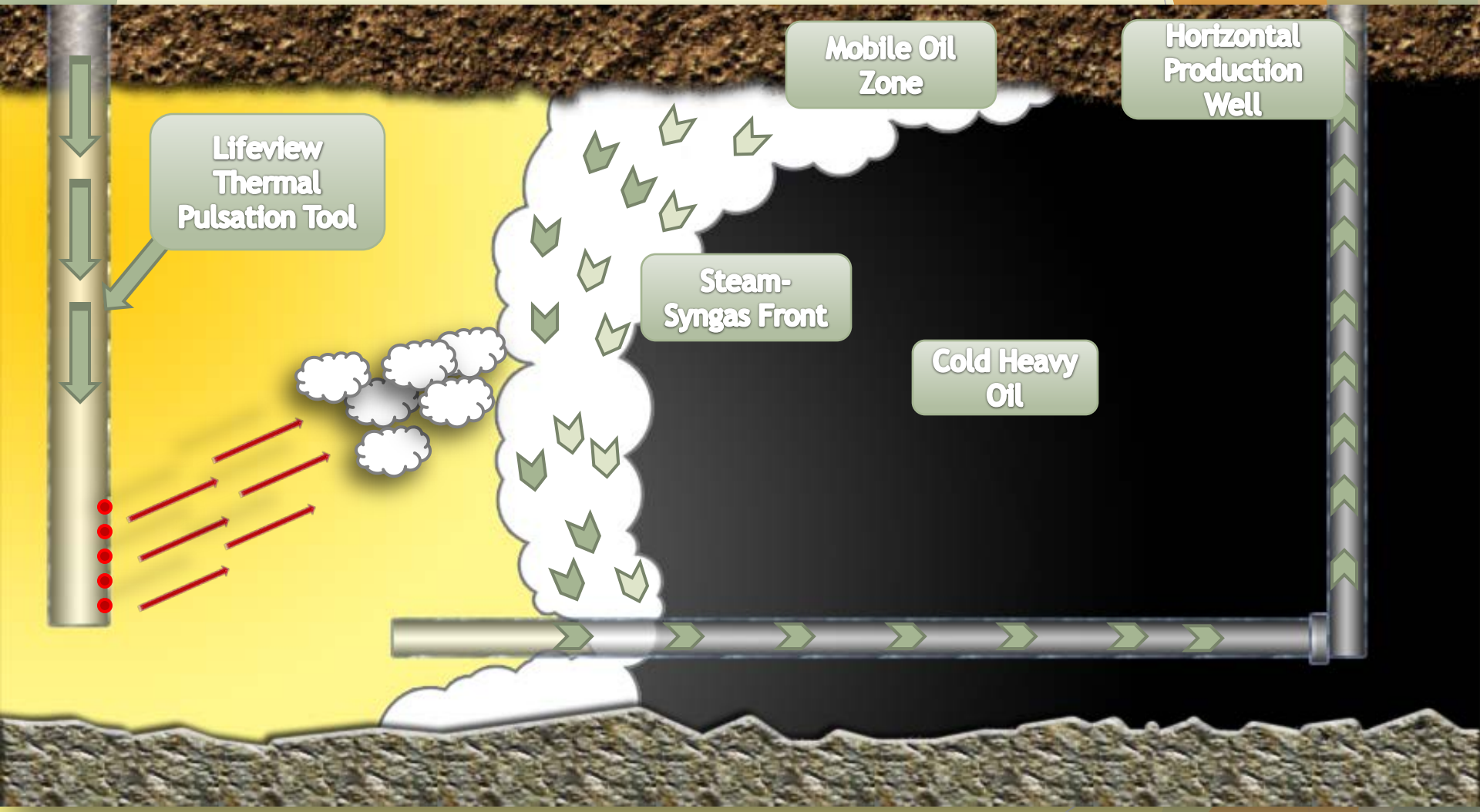
- The key is upgrading underground by making changes to the carbon chain and thermal application
- With the drive systems being used downhole, production is maximized.
- Zero Emissions from the injector process
- Green process

Reservoir-dependent information for process guidelines

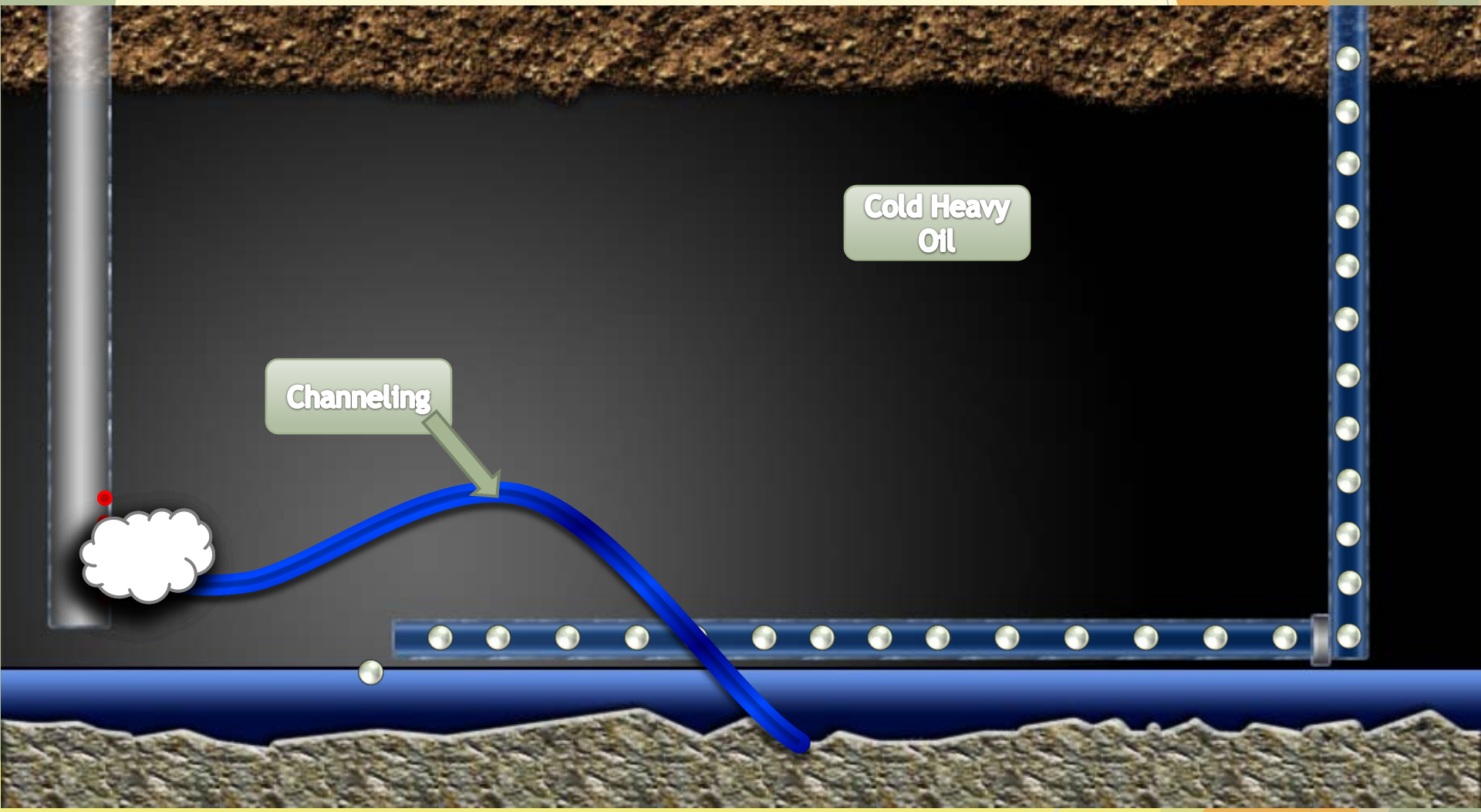
- Reservoir depth, Structure
- Reservoir fluid characteristics
- Flu Gas Injection rate
- Water / Catalyst Volumes
- Horsepower requirements
- Compression rates and pressures
- Electrical requirements for process and downhole tool

Once gathered we would be able to calculate the Mass and Energy Balance for effective production forecasting

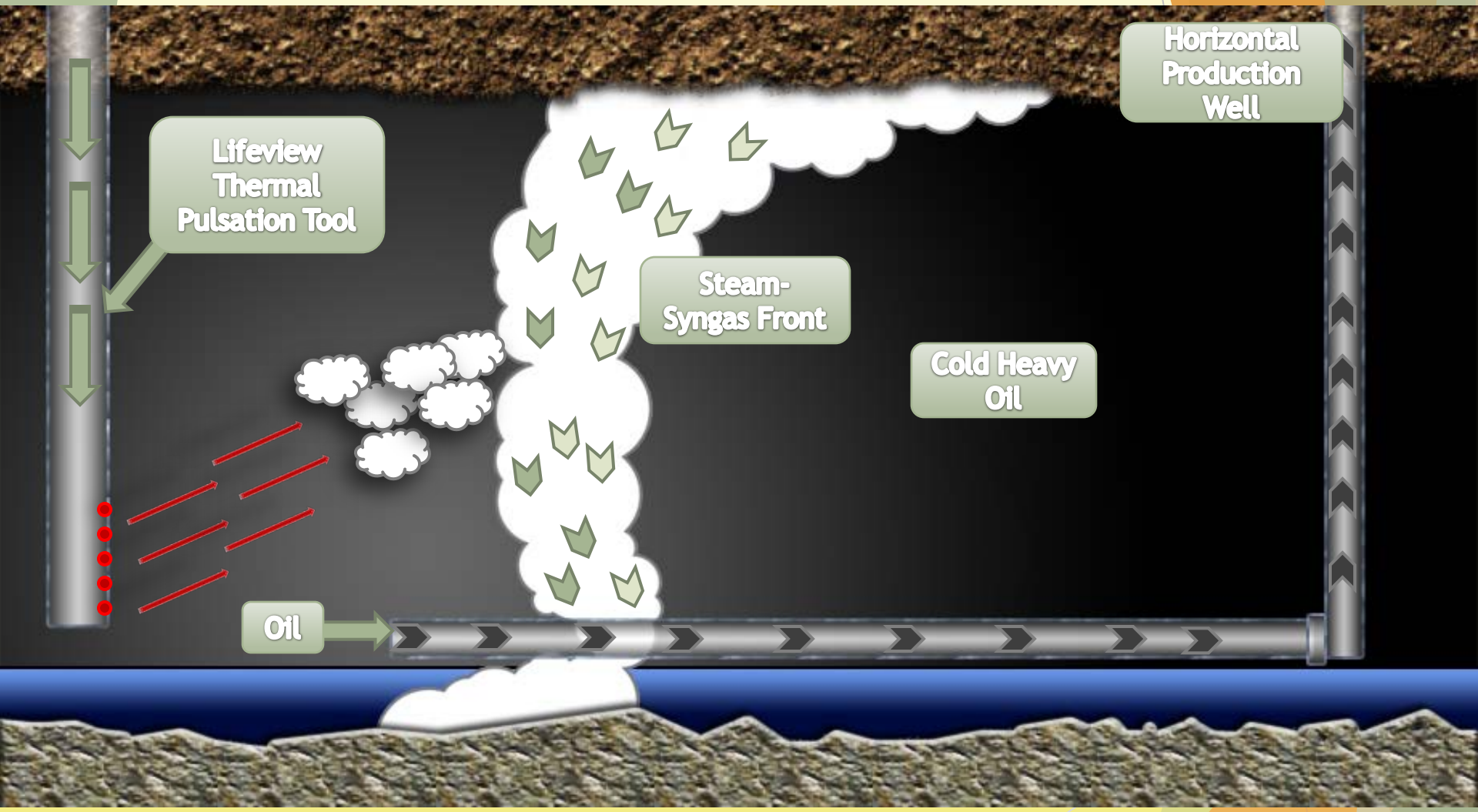
PRTISP Process



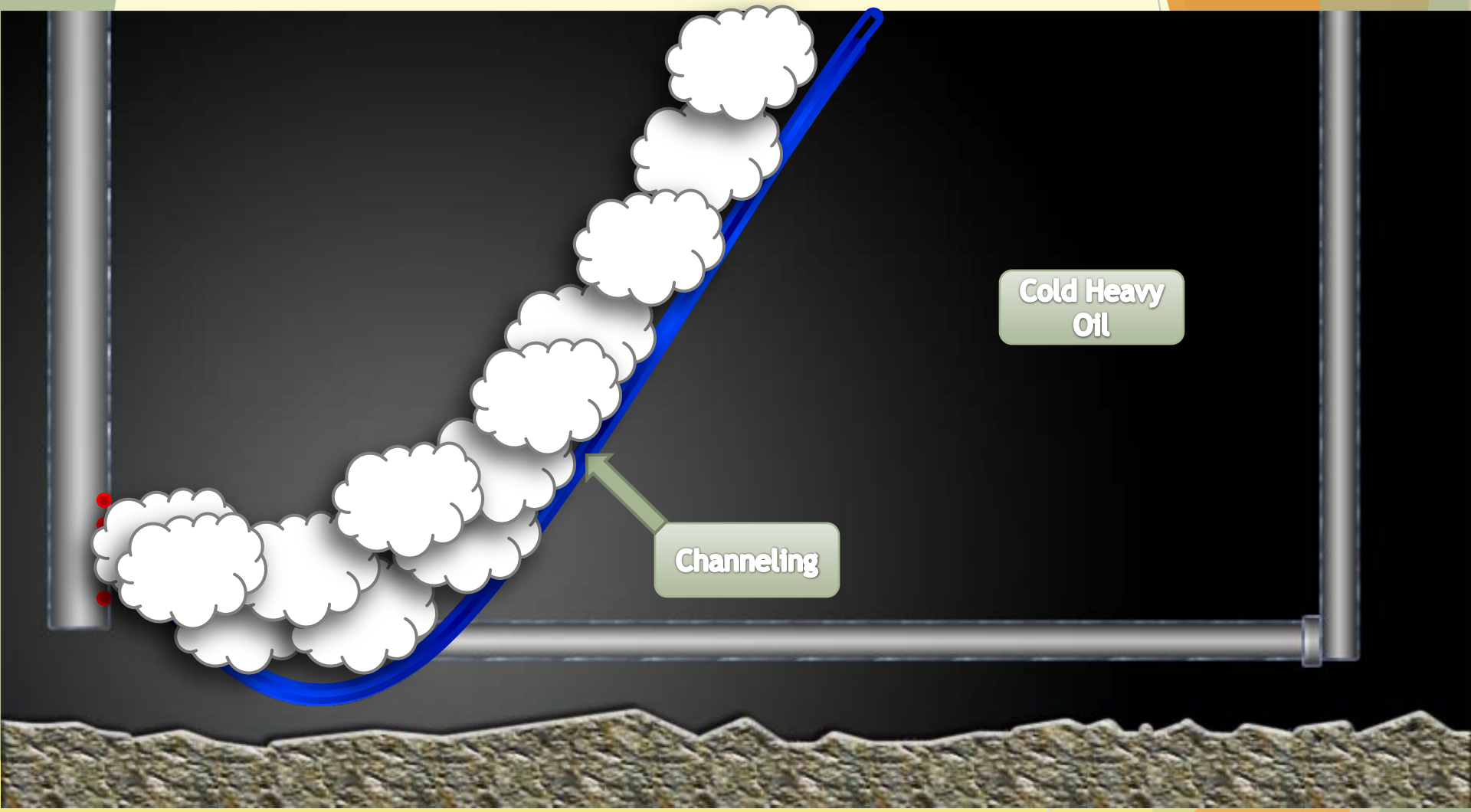
Bottom-water Problems with continuous steam injection

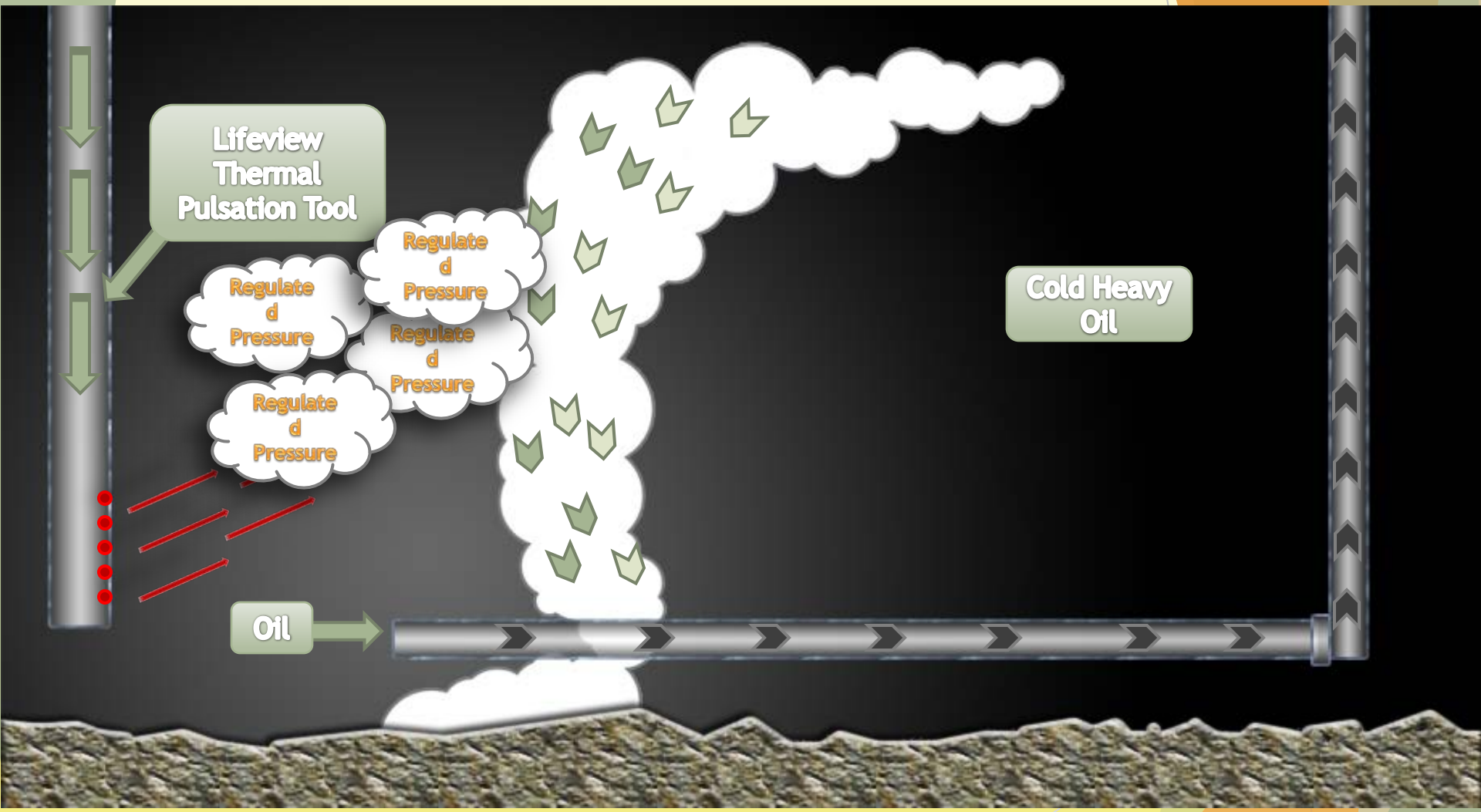


PRTISP process in bottom water

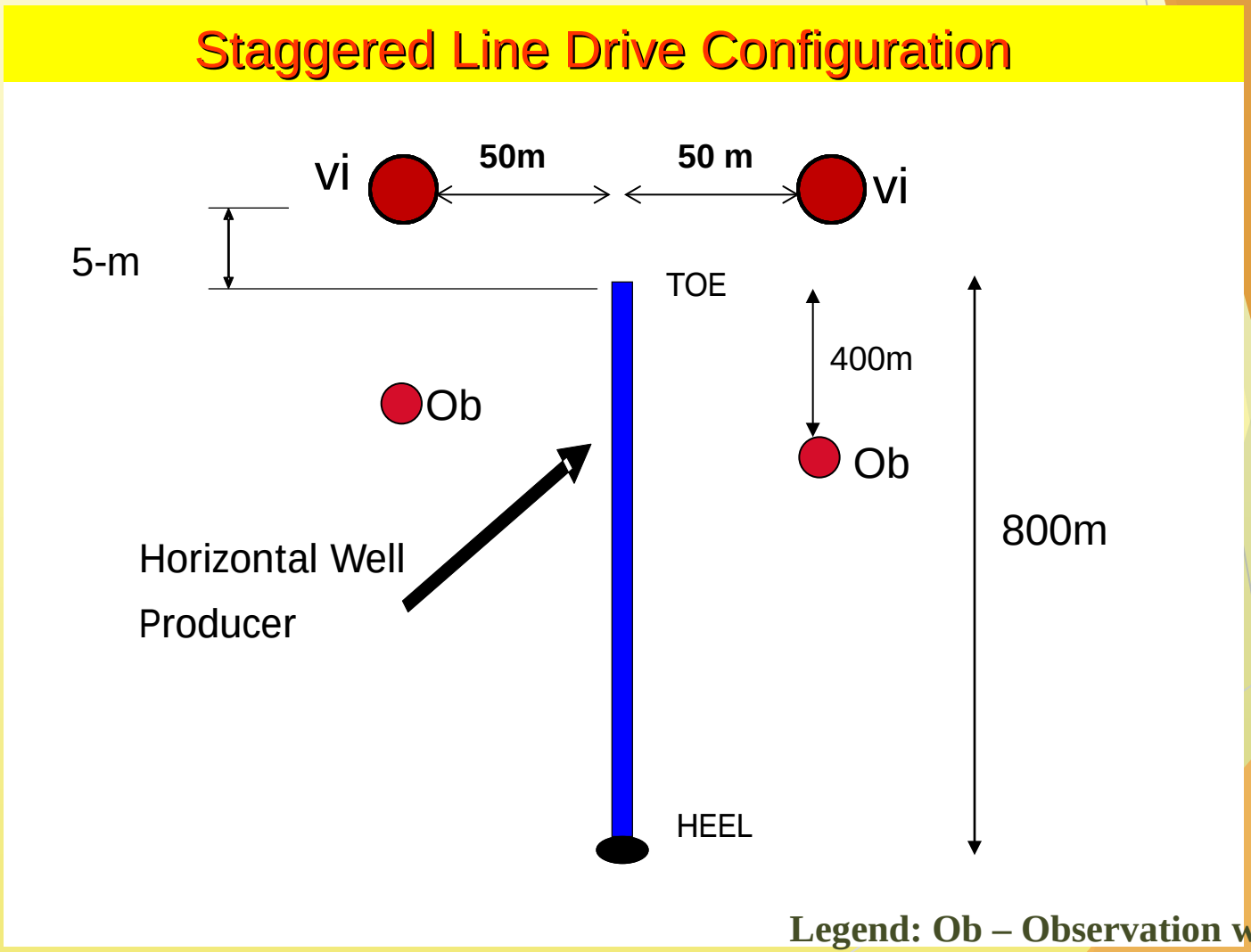


Lack of Cap Rock Problems with Continuous Steam Injection



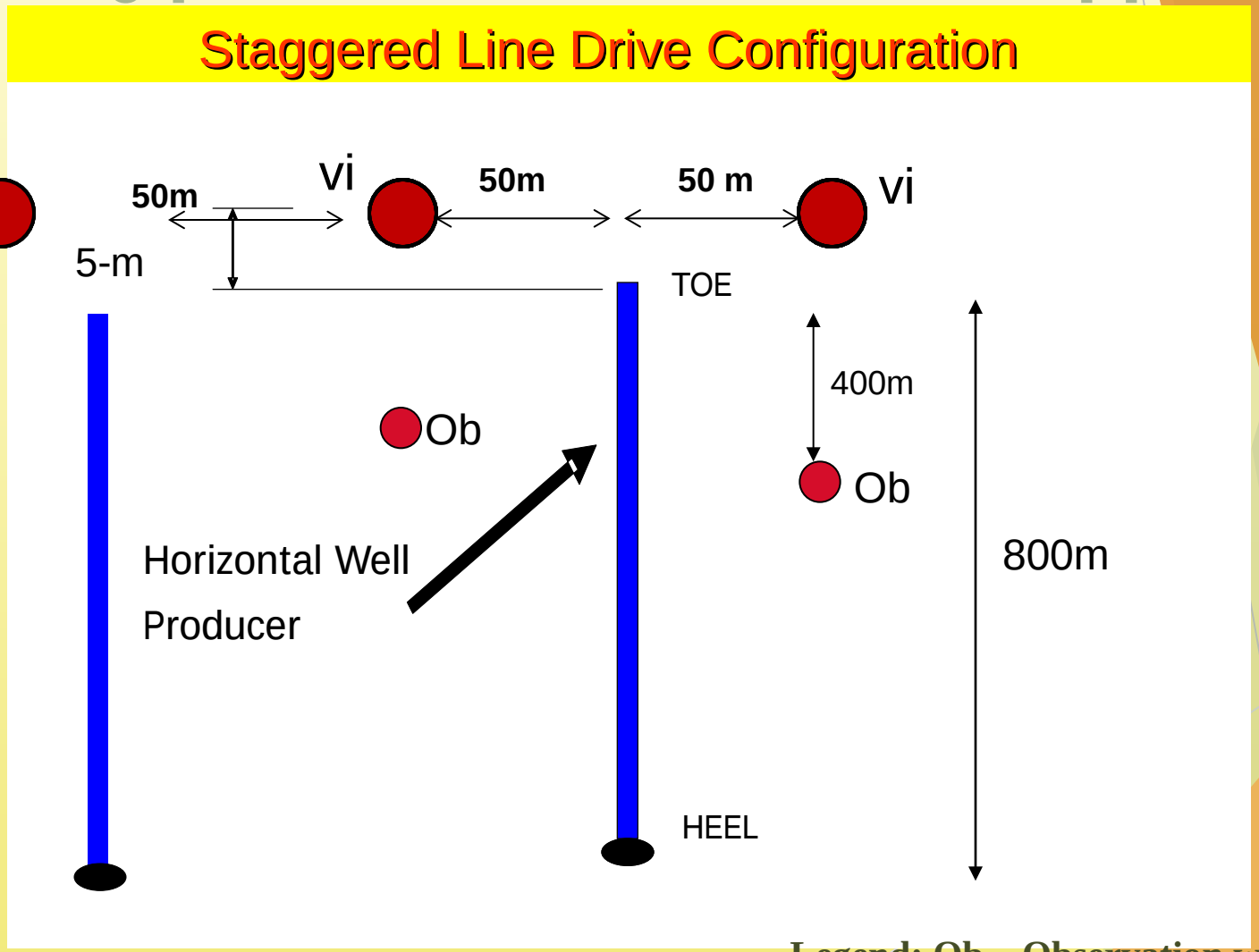


Bird`s eye view of the TTH(Toe to Heel) steam-syngas flooding process; well configuration.



Legend: Ob – Observation well, future vi
vi - vertical injector

Bird`s eye view of the TTH steam-syngas flooding process for Commercial Application



Legend: Ob – Observation well, future vi
vi - vertical injector

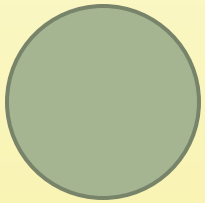
Field development implementation

- Existing oil fields that have pressure-depleted reservoirs
  - Re-establish reservoir drive
  - Increasing oil mobility by changing the phase permeability
- Heavy Oil Enhanced Oil Recovery program
  - Thermal application
  - Increase oil mobility by using pressure gradient
  - Chemical injection using Syngas / enriched
- Bitumen fields with bottom water

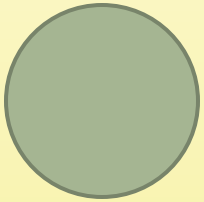
PRTISP Process for Heavy Oil Recovery and Conventional Oil

New deployment technique in areas with cold flow production, depleted production in mature fields

Conventional Heavy Oil / Carbonate Light Oil spacing per Section

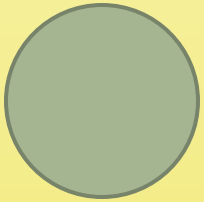


Vertical Production wells

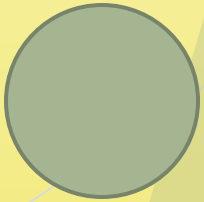


Vertical Production wells

Vertical Thermal Injector well



Vertical Production wells



Vertical Production wells